

What is claimed is:

1. A method for treating a mammal suffering from a life threatening level of red blood cell hemoglobin (RBC Hb) as the result of blood loss comprising administering to the mammal a polymerized hemoglobin solution.
- 5 2. The method of claim 1 wherein the hemoglobin solution is an acellular solution comprising an essentially tetramer-free, cross-linked, polymerized hemoglobin solution which is substantially free of stroma and other contaminants.
3. The method of claim 1 wherein the blood loss is a massive blood loss.
4. The method of claim 1 wherein the hemoglobin solution is administered in an amount
10 of at least 5L.
5. The method of claim 1 wherein the hemoglobin solution is administered in an amount of at least one blood volume of the mammal.
6. The method of claim 1 wherein the administration of the hemoglobin solution maintains a mean circulating hemoglobin level greater than 5.0 g/dL.
- 15 7. The method of claim 1 wherein the administration of the hemoglobin solution maintains arterial pressure above 60 mmHg.
8. The method of claim 1 wherein the hemoglobin solution is administered at a rate of at least about 2 units per minute.

9. The method of claim 1 wherein the solution avoids the toxicities associated with vasoconstriction, and renal, pancreatic, gastrointestinal and cardiac dysfunction.

10. A method according to claim 1, wherein the polymerized hemoglobin has a molecular weight distribution of:

- 5 (a) from about 5-30% by weight of polymerized hemoglobin of polymer having a molecular weight of about 128 KDa;
- (b) from about 15-35% by weight of polymerized hemoglobin of polymer having a molecular weight of about 192 KDa; and
- 10 (c) from about 35-75% by weight of polymerized hemoglobin of polymer having a molecular weight of about 256 KDa.

11. The method of claim 1 wherein the life threatening level of RBC Hb is less than 3.0 g/dL.

12. A method of preventing anemia, irreversible ischemia, or hypovolemic shock in a patient suffering from massive blood loss comprising administering to the patient a volume of a
15 polymerized hemoglobin solution sufficient to maintain total Hb above 5.0 g/l and arterial pressure above 60mmHg.

13. The method of claim 12 wherein hemoglobin solution is an acellular solution comprising an essentially tetramer-free, cross-linked, polymerized hemoglobin solution which is substantially free of stroma and other contaminants.

20 14. The method of claim 12 wherein prior to treatment the patient's level RBC Hb is less than 5.0 g/dL.

15. The method of claim 12 wherein prior to treatment the patient's level RBC Hb is less than 3.0 g/dL.

16. The method of claim 12 wherein the hemoglobin solution is administered in an amount of at least 5L.

5 17. The method of claim 12 wherein the hemoglobin solution is administered in an amount of at least one blood volume of the mammal.

18. The method of claim 12 wherein the administration of the hemoglobin solution maintains arterial pressure above 60 mmHg.

19. The method of claim 12 wherein the hemoglobin solution is administered at a rate of
10 at least about 2 units per minute.

20. The method of claim 12 wherein the solution avoids the toxicities associated with vasoconstriction, and renal, pancreatic, gastrointestinal and cardiac dysfunction.

21. A method according to claim 12, wherein the polymerized hemoglobin has a molecular weight distribution of:

15 (a) from about 5-30% by weight of polymerized hemoglobin of polymer having a molecular weight of about 128 KDa;

(b) from about 15-35% by weight of polymerized hemoglobin of polymer having a molecular weight of about 192 KDa; and

(c) from about 35-75% by weight of polymerized hemoglobin of polymer having a
20 molecular weight of about 256 KDa.

22. A method of maintaining mean circulating Hb levels above 5.0 g/dL in a patient suffering from massive blood loss comprising administering to the patient a polymerized hemoglobin solution in an amount of at least one blood volume of the patient.

23. The method of claim 22 wherein hemoglobin solution is an acellular solution comprising an essentially tetramer-free, cross-linked, polymerized hemoglobin solution which is substantially free of stroma and other contaminants.

24. A method according to claim 23, wherein the polymerized hemoglobin has a molecular weight distribution of:

(a) from about 5-30% by weight of polymerized hemoglobin of polymer having a molecular weight of about 128 KDa;

(b) from about 15-35% by weight of polymerized hemoglobin of polymer having a molecular weight of about 192 KDa; and

(c) from about 35-75% by weight of polymerized hemoglobin of polymer having a molecular weight of about 256 KDa.

25. The method of claim 22 wherein the hemoglobin solution is administered in an amount of at least 5L.

26. The method of claim 22 wherein the hemoglobin solution is administered in an amount of at least one blood volume of the mammal.

27. The method of claim 22 wherein the administration of the hemoglobin solution maintains arterial pressure above 60 mmHg.

28. The method of claim 22 wherein the hemoglobin solution is administered at a rate of at least about 2 units per minute.

29. The method of claim 23 wherein the solution avoids the toxicities associated with vasoconstriction, and renal, pancreatic, gastrointestinal and cardiac dysfunction.

5 30. A method for treating a human having a hemoglobin concentration below about 7 g/dL as the result of a massive blood loss and, comprising administering to the human a polymerized hemoglobin solution.

31. The method of claim 30 wherein hemoglobin solution is an acellular solution comprising an essentially tetramer-free, cross-linked, polymerized hemoglobin solution which is
10 substantially free of stroma and other contaminants.

32. The method of claim 30 wherein the hemoglobin solution is administered in an amount of at least 5L.

33. The method of claim 30 wherein the hemoglobin solution is administered in an amount of at least one blood volume of the mammal.

15 34. The method of claim 30 wherein the administration of the hemoglobin solution maintains a mean circulating hemoglobin level greater than 5.0 g/dL.

35. The method of claim 30 wherein the administration of the hemoglobin solution maintains arterial pressure above 60 mmHg.

36. The method of claim 30 wherein the hemoglobin solution is administered at a rate of at least about 2 units per minute.

37. The method of claim 30 wherein the solution avoids the toxicities associated with vasoconstriction, and renal, pancreatic, gastrointestinal and cardiac dysfunction.

38. A method according to claim 30, wherein the polymerized hemoglobin has a molecular weight distribution of:

(a) from about 5-30% by weight of polymerized hemoglobin of polymer having a molecular weight of about 128 KDa;

(b) from about 15-35% by weight of polymerized hemoglobin of polymer having a molecular weight of about 192 KDa; and

(c) from about 35-75% by weight of polymerized hemoglobin of polymer having a molecular weight of about 256 KDa.

39. A method for sustaining life in a human suffering from massive blood loss comprising preventing hypovolemic shock and further decrease in blood pressure by administering to the human a polymerized hemoglobin solution.

40. A method according to claim 39, where and the human has a hemoglobin concentration below about 7 g/dL.

41. The method of claim 39 wherein hemoglobin solution is an acellular solution comprising an essentially tetramer-free, cross-linked, polymerized hemoglobin solution which is substantially free of stroma and other contaminants.

42. The method of claim 39 wherein the hemoglobin solution is administered in an amount of at least 5L.

43. The method of claim 39 wherein the hemoglobin solution is administered in an amount of at least one blood volume of the mammal.

5 44. The method of claim 39 wherein the administration of the hemoglobin solution maintains arterial pressure above 60 mmHg.

45. The method of claim 39 wherein the hemoglobin solution is administered at a rate of at least about 2 units per minute.

46. The method of claim 39 wherein the solution avoids the toxicities associated with
10 vasoconstriction, and renal, pancreatic, gastrointestinal and cardiac dysfunction.

47. A method according to claim 39, wherein the polymerized hemoglobin has a molecular weight distribution of:

(a) from about 5-30% by weight of polymerized hemoglobin of polymer having a molecular weight of about 128 KDa;

15 (b) from about 15-35% by weight of polymerized hemoglobin of polymer having a molecular weight of about 192 KDa; and

(c) from about 35-75% by weight of polymerized hemoglobin of polymer having a molecular weight of about 256 KDa.